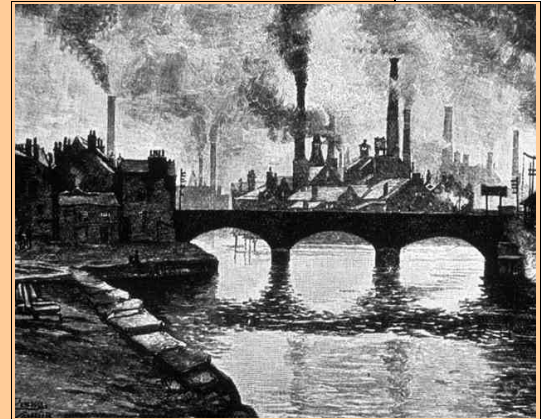


UNIT 5 – The Industrial Revolution

- Introduction
 - Inventions
- Before the Industrial Revolution
- Inventions that fuelled the Industrial Revolution
 - *Flying Shuttle*
 - *Spinning Jenny*
 - The water frame
 - The steam engine
 - The locomotive (train)
- Life during the Industrial Revolution
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- Riots against the Industrial Revolution
- The importance of the railways
- Social changes
- The second Industrial Revolution
- Alternative answers to the Industrial Revolution



Introduction

The Industrial Revolution began in Britain in the mid-18th century, transforming society as people moved from the countryside to the town in order to work in factories.

Two inventions in the early 18th centuries helped make the Industrial Revolution possible:

- Abraham Darby's discovery that coke instead of charcoal was a better fuel for smelting iron.

STEAM ENGINE

Credited to a popular old story, the British inventor James Watt, whose name did not get the credit the steam engine while working steam flow the "let off a rivet" method, the Watt's parallel motion mechanism as he studied the genius of the university of Glasgow. But Watt was not the first person to build a working steam engine. That credit properly belongs to an inventor named Thomas Newcomen, who built a steam-powered pump in 1712.

Newcomen's engine, the first steam engine, works on the principle that steam takes down and condenses back into water. It takes up the space of the condensation tank that is a limited cylinder or reservoir, or running piston, is created. Steam engine would rise building piston to move a piston up and down inside a cylinder. The piston is kept within a guide that will push it sideways when steam underground enters. But James Watt realized that a lot of energy was being wasted by heating and cooling the cylinder on every stroke. Watt made several changes in Newcomen's design that helped to greatly increase the power and efficiency of steam engines.

The invention of the steam engine changed the nation almost overnight. Steam power was suddenly put to work in everything from mines to factories to heavy work. The steam engine made the Industrial Revolution of the 18th century possible. And it was the Industrial Revolution that transformed our society from one in which most people worked for a living to one in which most people worked in factories and offices. In one stroke, the steam engine began the process of separating the "haves" from the "have-nots." The nations that were able to take advantage of their power were able to become world powers. Those that did not take part in the steam revolution were left behind, and many of them are still trying to catch up.

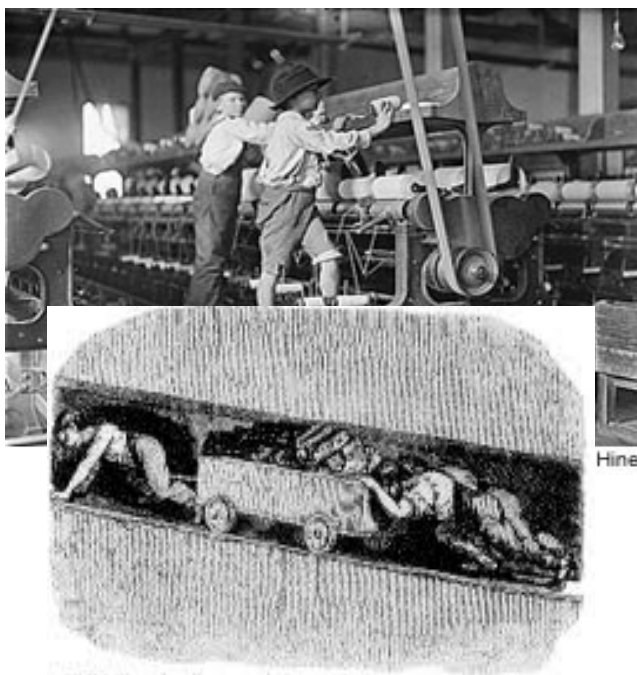
- Thomas Newcomen's improved steam engine, used to pump water out of coal mines.

These two inventions meant that more coal and better quality iron could be produced for industry.

Until 1760 most goods were hand-made by people working at home or in small workshops. Many were spinners and weavers, producing woollen or linen cloth. Others made small metal items, such as nails, pins and knives. From the start of the century there had been a rising demand for cotton clothes. Raw cotton was imported from India and British spinners and weavers started manufacturing cloth.

The first inventions of the Industrial Revolution were related to textile industry: new machines like the **Flying Shuttle** (1733), the **Spinning Jenny** (1764) and the **Spinning Frame** (1769) a **machine powered by water**. Factories were built near streams and soon the cotton industry began to develop on a very large scale.

By 1790, James Watt's new steam engine meant that steam power could be used to drive the machines. This increased the demand for coal to heat the water to make steam and for iron to make the engines and other machinery. Coal mines became bigger and deeper and iron works and foundries expanded. Canals (and later railways) were built to bring raw materials to the factories and take the finished goods away.



Towns boomed as people moved in to be near their place of work.

Both housing and working conditions were often poor and many people, including children, suffered from

malnutrition, disease, or accidents at work.

Children worked in coal mines from the age of five. Some children sat all day in total darkness, opening and closing doors to let the air circulate. Older children pulled heavy loads.



The Railway. The first public railway from Stockton to Darlington, opened in 1825. Steam locomotives were used to carry passengers in covered carriages.

TASKS:

- 1. When and where did the Industrial Revolution start?**
- 2. Name the two inventions that made it possible.**
- 3. Which three raw materials were very important for the new industries?**
- 4. How could they get the power to drive machines?**
- 5. What were the spinners and weavers for? What did they make?**
- 6. Name three machines invented in the late years of the 18th century.**
- 7. Explain the situation of the workers in those years.**
- 8. When was the railway born? And where?**

Before the Industrial Revolution

Before the dawn of the Industrial Revolution Britain (and Europe) was a quite different place than what exists today. Industrialisation brought with it new types of roads, trains and many other forms of transportation which simply did not exist before the industrialisation. Before the Industrial Revolution it was very hard to keep in touch with other parts of the country. News was spread by travellers or through messengers and goods were distributed within the place where they were produced.

It was very difficult to move around: there were no cars, aeroplanes or even tarmac roads. Food was produced locally. Clothing was made locally, making use of animal hides and furs; cotton clothing developed with the Industrial Revolution. Most of the people were farmers. People worked in villages and small towns, working the land and relying upon the local community to provide for them. Only some people were fortunate enough to buy the imported goods which came into ports such as London or Bristol.

Sources of energy were natural ones, such as wind for windmills or for navigation.

Education was poor, only the rich went to high schools or universities. Ordinary men and women had very few rights. For them life was a fight against famine. The Industrial Revolution would change only some of their worries.

TASK:

9. Relate these features with the world before the Industrial Revolution or after it.

	BEFORE the Industrial Revolution	AFTER the Industrial Revolution
Cars		
Rural life		
Factories		
Small villages		
Energy sources		
Machinery		
Windmill		
Railways		
International Trade		
Farming		
Towns and cities		
Local trade		
Workers		
Farmers		

Inventions that fuelled the Industrial Revolution

We are going to describe now the most important inventions:



The Spinning Jenny

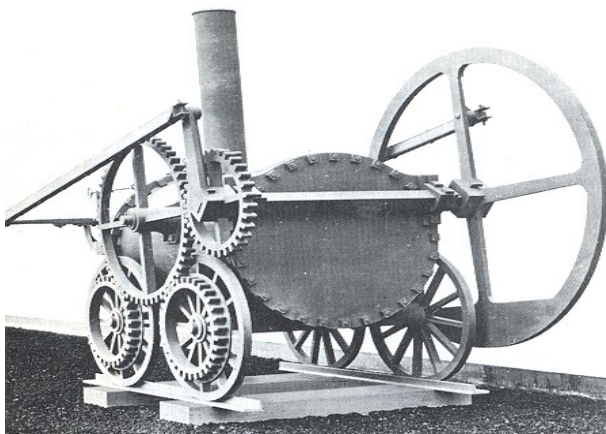
It was a machine that could spin threads of wool. It was invented by James Hargreaves. In some of these machines you could spin 120 threads at one time. These machines were small enough to fit into cottages and rapidly increased production.

The Water Frame

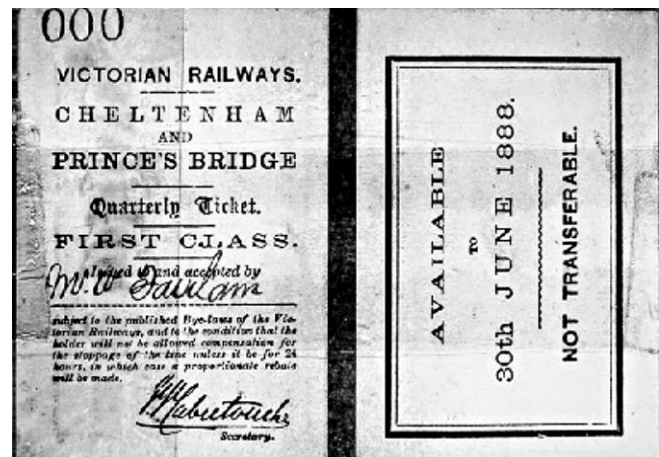
It was patented by Richard Arkwright in 1769. It was a large wheel that was turned by running water. This was then harnessed to turn cogs inside a factory which then made the machinery work. This machine is regarded as being the catalyst of the Industrial Revolution.



The Steam Engine



James Watt refined Thomas Newcomen's old steam engine. Now the steam was used to create energy. The machines could be used anywhere. The steam engine is associated with the invention of trains, but it was also used to power machinery or lifts.

The locomotive (train)

In 1808 Richard Trevithick created the first locomotive to run on rails. But his ideas were refined by George Stephenson, who built a new locomotive in 1814. In 1830, he built the famous *Rocket*, which ran the Manchester-Liverpool line.

TASK:

10. Write a small description of each invention, explaining what they were for, the inventor's name and the dates.

**Life during the Industrial Revolution**

Living conditions during the Industrial Revolution ranged from the splendour of the homes of the owners to the squalor of the lives of the workers.

Homes of the wealthy

Rich people lived in large homes surrounded by a massive garden, the estate itself could spread for several miles.

Homes of the poor

Poor people lived in small houses in cramped streets. These homes would share toilets, have open sewers and would be susceptible to damp.

Middle class people like doctors or lawyers lived in better homes and during the 19th century the conditions of the poor improved due to government initiatives that made cities cleaner.

Migration during the Industrial Revolution

Millions of people moved during the Industrial Revolution. The main reason for moving during the 19th century was to find work. This involved movement from the countryside to the growing industrial cities like Manchester or Liverpool (or Barcelona in Spain). Cities grew a lot in less than a century and, for the workers life was not easy. So many Europeans, poor Europeans, tried to start a new life in America, most of them in the USA.

TASK:

11. Explain both types of migration during the Industrial Revolution.

Working Conditions in the Industrial Revolution

At the start of the Industrial Revolution working in a factory could be a very dangerous activity.

Industries such as the cotton trade were particularly hard for workers to endure long hours of labour. The nature of the work being done meant that the workplace had to be very hot, steam engines contributing further to the heat. Machinery was not always fenced off and workers would be exposed to the moving parts of the machines.



Children were often employed to move between these dangerous machines. Of course, mortality (death rates) was quite high in factories. Besides the danger, you must consider the number of hours worked. It was quite common for workers to work 12 hours a day. Exhaustion makes the workplace more dangerous.

Some reforms (Acts) were made to improve the conditions of work.

- Factory Act (1819): Limited the hours worked by children to 12 per day.
- Factory Act (1833): Limited the hours worked by children to 48 a week.
- Factory Act (1847): maximum of 10 hours work per day for women and children.

TASKS:

12. Make a comparison between the working conditions in the Industrial Revolution and nowadays.
13. Write your opinion about child labour in the factories.
14. Before the Industrial Revolution:
 - a) People lived...
 - b) People produced...
 - c) People made...
 - d) Goods were made...
 - e) Goods were transported...
15. The Industrial Revolution was possible because...
 - a)
 - b)
 - c)
 - d)
 - e)
16. Machines and factories. Explain the relation between: cotton, Spinning Jenny and factories.
17. Power for machines
 - a) before the Industrial Revolution
 - b) during and after the Industrial Revolution
 - coal
 - iron

Riots against the Industrial Revolution

People were afraid of losing their jobs because:

- Common land was being enclosed. This meant many country people couldn't make a living because they had nowhere to graze their animals.
- New machines and working methods were invented and introduced in farming and industry.
- Improvement in transport (especially roads and canals) meant industrial changes could happen more quickly.
- The price of wheat was very high, but wages were very low, so people couldn't afford much food.
- After the war against France soldiers came back and had no job.

Different groups started riots, for example:

The **luddites** were named after Ned Ludd (their leader). They smashed factory machines (1811-1813). Rioters were executed or deported to Australia as convicts.

At the same time the middle class grew during the 1800s; old cities were growing and new ones were established.

The importance of the railways (1825-1868)

In 1785 the first Boulton and Watt rotary steam engine was used in a factory.

Social Changes

At the same time the growth of the railways, banking system and civil service led to an increase in middle class professionals running the administration. There was also a growth in other professions such as law and medicine.





The Victorian middle classes enjoyed new leisure activities like theatre, music hall, spa towns, and sports (rugby and cricket developed at this time).

Cities were growing fast during the 1800s. In 1700 20% of the population lived in cities,

by 1850 it was 55%. At first some of these cities weren't nice places to live because these cities had grown too fast to have many public services.

TASKS:

18. What was the Industrial Revolution?

19. Why do we use the word *Revolution*?

20. Which 3 of the following changed dramatically because of the Industrial Revolution?

- Transportation
- Post-it notes
- Bed and breakfast
- Industry
- Farming
- State companies

21. Why did some protestors smash factory machines?

22. How did the authorities punish people who protested against the changes of the Industrial Revolution?

23. Write a short paragraph to explain why the middle class grew during the 1800s

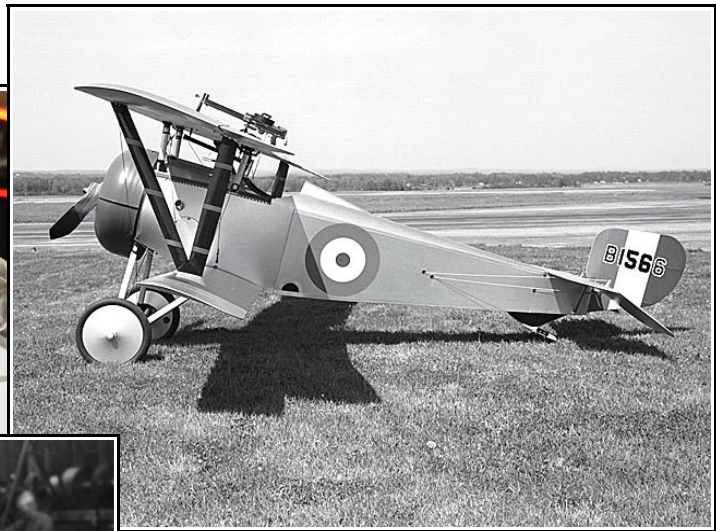
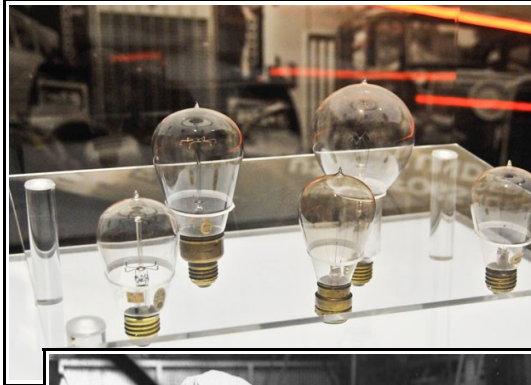
24. Describe 3 types of leisure activities enjoyed by the Victorian middle classes.

25. Explain the relation between: cotton, Spinning Jenny and factories.

26. Using information from the books and websites mentioned at the end of the unit, write a report about:

- the jobs children had
- accidents which often happened
- punishments children faced
- the food they were given
- the hours they worked
- appearance of the children
- age of children in factories
- working conditions
- education
- what happened to the money they earned

The Second Industrial Revolution



The second industrial revolution or the *Technological Revolution* was a phase of the industrial revolution from the second half of the 19th century until World War I

It began with Bessemer steel in the 1860s and culminated in mass production and the assembly line.

It happened in western Europe (Britain, Germany, France, the Low Countries, Denmark), the United States, and, after 1870, also in Japan.

The second industrial revolution revolved around steel, railroads, electricity, and chemicals.

- The Bessemer process was an invention to mass produce steel from molten iron. Its inventor was Henry Bessemer. He revolutionized steel manufacturing by decreasing costs, increasing the production and decreasing labour for steel-making.
- The petroleum industry, both production and refining began during the second industrial revolution producing kerosene for lamps and heaters.
- Thanks to the invention of electricity the assembly line and mass production developed.
- Henry Ford started mass production in his factory. All the machines were powered by electricity and they were positioned on a line eliminating

unnecessary human movements, to complete the process of mass production. The Ford Model T made like this was much cheaper than other cars (from \$780 to \$360).

- Electrification also allowed the inexpensive production of electrochemicals like: aluminium, chlorine, magnesium ...
- Railroads and ships were built using steel instead of iron.
- The gasoline powered automobile was patented by Karl Benz in 1886. Henry Ford built his first car in 1896.
- Electricity was used for street lighting in the early 1880s. Electric lighting in factories greatly improved working conditions. It was adapted to power street railways ...
- Telegraph lines were installed along rail lines initially for communicating with trains, but later became a communications network.
- The telephone was patented in 1876 and like the early telegraph, it was used mainly to speed business transactions.

Socioeconomic impact

- ➔ Living standards improved a lot in the newly industrialized countries as the prices of goods fell dramatically. This caused unemployment, with many labourers being displaced by machines in factories and ships became obsolete in a very short time.
- ➔ Crop failures no longer resulted in starvation in areas served by railroads or waterways.
- ➔ Horses and mules remained important in agriculture until the development of the tractor near the end of the second industrial revolution.
- ➔ The improvements in steam engine efficiencies allowed ships to carry much more weight resulting in greatly increased volumes of international trade.
- ➔ The prices of almost all goods decreased a lot.
- ➔ There were a lot of changes in the working class, now more professional, with a larger middle class, the decline of child labour and the dramatic growth of a material culture.

→ By 1900, the leaders in industrial production were the US (24% of the world total), Britain (19%), Germany (13%), Russia (9%) and France (7%).

Only a few major inventions occurred in the post war era, such as: computer, internet, cellular telephones, jet engines, the Green Revolution, commercial aviation ...

TASKS:

27. Name the two most important inventions.

28. Why do you think that the assembly line made goods cheaper? How did it work?

29. What was the first use of telegraphs?

30. And the first use of phones?

31. After reading the socioeconomic impact section, explain:

a) Why the standard of living improved a lot

b) Give three reasons for that

32. Compare the first and the second industrial revolution. Don't forget to mention: countries, inventions, the type of industries, living conditions...

Alternative answers to the industrial revolution

- **Utopian, comunitarian socialism.** This includes a great variety of utopian movements and thinkers. They want to change society adopting egalitarian lifestyles, building cooperatives and communes that will be an example for the rest of the world. For example, the **Fourierists**, **Owen's** new harmony... both in the 19th century.
- **Communism, Marxism or Scientific socialism.** It was created by Karl Marx with Friedrich Engels's help. Marx divided society into two groups:
 - those who own and control the means of production
 - and those who are exploited.

These classes fight for resources throughout history and when the economic base of the society changes, a new class develops to overthrow the previous ruling class.

After the French Revolution, the bourgeoisie replace the nobility in controlling the power; later the proletariat overthrows the bourgeoisie and there will be no

more class divisions and humanity will control its own evolution. **Capitalism** (private ownership of means of production) will be replaced by socialism (social ownership). The dictatorship of the bourgeoisie is replaced by *the dictatorship of the working class* under socialism. Finally the idea of ownership itself will disappear, and also all class divisions, and even the need of a state will disappear, and that'll be communism.

- **Anarchism.** The term comes from the Greek “*anarchos*” (without rules). It is the political belief that society should have no government, laws, police, or other authority, but should be a free association of all its members. There are many types of anarchism. Some anarchists are against all forms of aggression or violence, while others support the use of violence even revolutions to get an anarchist society. The French *Pierre Joseph Proudon* and the Russians Mikhail Bakunin and Peter Kropotkin were some of the most important anarchists.

Final test

1. Say if these statements are true for 1750 or for 1900:
 - a) The population in Britain was 6 million.
 - b) Most people lived in towns.
 - c) Many children died very young.
 - d) Farming was the most important industry.
 - e) Railways covered the whole country.
 - f) Only rich men could vote.
 - g) The journey from Edinburgh to London took 10 hours.
2. Write the names of two important people from the Industrial Revolution and explain why they were important.
3. Name two inventions from the Industrial Revolution.
4. Why did the population grow in Britain?
5. What were the negative results of urbanisation?
6. List the advantages of canals.
7. Who invented the Rocket?
8. Why was the railway important for the Industrial Revolution?
9. What jobs did children have in the 19th century?
10. How did people in the nineteenth century see the role of women?

Find out more at...

- these websites:
 - www.schoolhistory.co.uk (general information for students- simple language)
 - www.wikipedia.com (general information)
 - http://www.bbc.co.uk/history/british/victorians/workshop_of_the_world_01.shtml (BBC page about aspects of the Industrial Revolution: Victorian society)
 - http://www.bbc.co.uk/history/british/victorians/speed_01.shtml (change in the Victorian World)

- these books from the school library:
 - BINGHAM, Jane et al.: *The Usborne Internet-Linked Encyclopedia of World History*. Usborne.2000. Pages 338-341. ISBN: 97807-4605361-4 (interesting links to their website)
 - CLEMEN, Gina D: B.: *Great English Monarchs and Their Times*. + CD. Black Cat. Vicens Vives. 2000. ISBN: 843165329-9
 - GANERI, Anite et al.: *Encyclopedia of World History. From the Stone Age to the 21st Century*. Parragon. United Kingdom. 2005. Pages 164-165. ISBN: 1-405-45-684-1
 - *Key Stage Three History. The Study Guide*. CGP. United Kingdom. Pages 29-31. ISBN: 978-1-84146-330-8
 - McCAFFREY, Susie et al.: *The Usborne-linked First Encyclopedia of History*. 2003. Pages 56-57. ISBN: 079450386-1
 - MURPHY, Derrick et al.: *Europe 1760-1871. Flagship History*. Collins. 2000, 2002. ISBN: 0-00-327132-3

- these novels:
 - DICKENS, Charles: *A Tale of Two Cities*. Black Cat. Vicens Vives. 2003. ISBN: 887754860-6
 - DICKENS, Charles: *David Copperfield* + CD. Black Cat. Vicens Vives. 2004. ISBN: 843167686-3
 - DICKENS, Charles: *Great Expectations* + CD. Black Cat. Vicens Vives. 2002. ISBN: 843166441-X
 - DICKENS, Charles: *Hard Times*.
 - DICKENS, Charles: *Oliver Twist*. + CD. Black Cat. Vicens Vives. 2003. ISBN: 843167069-X

- these films:
 - *Modern Times*
 - *Oliver Twist*
 - *The Young Victoria* (2009), the early years of Queen Victoria

